

Life Sciences Research and Development Opportunities During Suborbital Space Flight

Jeffrey R. Davis, MD

(Director, Space Life Sciences, NASA Johnson Space Center)

Summary

Suborbital space platforms provide a unique opportunity for Space Life Sciences in the next few years. The opportunities include: physiological characterization of the first few minutes of space flight; evaluation of a wide-variety of medical conditions during periods of hyper and hypo-gravity through physiological monitoring; and evaluation of new biomedical and environmental health technologies under hyper and hypo-gravity conditions.

Introduction

At the present time, very little is known about the physiological consequences of the first few minutes of space flight under hyper-gravity followed by hypo-gravity exposures. Since many individuals will fly under similar conditions, large data sets can be acquired if the appropriate pre- and post-flight data is collected along with focused in-flight data collection of physiological parameters. Current long-duration flight operations do not permit the evaluation of novel technologies with redesign and reflight in short periods of time.

Approach

Pre- and post-flight data collection can be acquired through the medical examinations performed by the various commercial space flight operators. Ideally a centralized database of these data will be collected in a non-attributable manner so that group data can be analyzed for the benefit of all future passengers and operators. In-flight data can be collected by very sophisticated

biomedical and environmental equipment that can collect samples with non or minimally invasive methods. High data rate collection would be preferred to capture physiological variations during short exposures. Since many individuals will fly with medical conditions not before flown in space via government space operations, various passenger cohorts can be established to accurately determine the response of a wide-range of medical problems under hyper- and hypo-gravity exposures. These data can then be utilized to determine risk-management by the operators, inform medical standards for crew of commercial space vehicles and government space operations, and to suggest future areas of research during longer duration government space operations such as the International Space Station (ISS).

Novel technologies to provide biomedical diagnostic and therapeutic monitoring can be assessed for their performance during suborbital operations. Since flights can be repeated at frequent intervals, equipment can be tested, data evaluated, operational changes performed and equipment reflown in short periods of time. This adaptive design capability allows rapid prototyping, test/evaluation, and redesign in short periods of time, and may permit the more rapid development and flight certification of novel technologies. These technologies may therefore be more robust when considered for longer duration space flight by government space operations with flight durations of weeks or months.